

## **A Component Head Injury Criteria Tester for Aerospace Applications**

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Full-scale sled tests, which are currently required as part of an aircraft interior certification, often require several seat test articles to be destroyed in order to develop an engineering solution, and to demonstrate compliance with the Head Injury Criteria (*HIC*) for a particular design. The *HIC* compliance poses a significant problem for the airlines and the manufacturers of the jet transports due to high costs and schedule overruns during the development and certification of aircraft seats. This paper details the steps taken in the development of an alternate component tester for the evaluation of *HIC* without consuming a seat during each test. Initially, the kinematics of a Part 572 Hybrid II anthropomorphic test dummy (ATD) during a 16G dynamic seat test were analyzed in order to arrive at the initial design of the component *HIC* tester. Parametric studies were then performed with the validate models in order to come up with an optimum design of the system. The device was then fabricated and a control system was also developed for it. The system was then calibrated for typical cabin arrangements for front-row bulkhead seating. The system is quite versatile as it can be operated at different modes utilizing one or two degrees-of-freedom, related to the rotation of the upper torso as well as the translation of the pelvic area. The system can also be operated with different pendulum arms or in effect different effective masses at various seat arrangements relative to the head impact frontal structure. The tests conducted with this enhanced component *HIC* tester have indicated that the system provides a reasonable correlation compared with the results of a 16G full-scale sled tests in term of the *HIC*, window size, peak acceleration, average acceleration, and general trend of the head acceleration profile. This component testing device has proven to be easier to setup, reduces the cost, produces less scatter on *HIC* data, is appropriate for identifying critical impact parameters, and may eventually be used as a certification tool.